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ABSTRACT

In the past two decades, computer assisted reading instruction has developed substantially. From educators using large mainframe computers located at a distance from keyboard terminals in classrooms, today reading educators are capable of using computer-assisted instruction (CAI) on typewriter-sized equipment portable to any location and usable anywhere. Although some investigations have shown computer-assisted instruction to be more effective than teacher-directed instruction, many more investigations are needed before that question can be answered definitively. Nevertheless, research studies have had several important instructional implications: (1) CAI currently has the capability of performing instructional tasks of a drill and practice type; (2) CAI's effect on reading achievement is equal to but no greater than that of teacher directed instruction; (3) students generally demonstrate positive attitudes toward computers, although poorly constructed CAI lessons bore students just as poorly constructed teacher prepared and delivered lessons do; and (4) relatively few teachers were involved in the early experimental research studies as reading experimentation was left to professional computer experts. (HOD)

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Computer Assisted Reading Instruction Research

by

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Computer Assisted Reading Instruction Research

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INTRODUCTION

Computer use in reading programs is a relatively recent development. Computers have not nudged into many classroom reading programs; however, it is difficult to see how any teacher of reading will not be touched and affected by this electronic phenomenon within a short period of time, perhaps five years. This prediction is not meant to convey the notion that computers are to be feared, only that they have a beachhead, and inevitably will sweep into every classroom. It is not a question of will they, but only, when.

Little wonder is it that widespread computer use in reading programs has not been heralded when one reads the following "Press Release."

Dateline: April 1977 New York

At the American Educational Association Conference, Dr. Robert F. Yeager (1977, p. 35) of the University of Illinois presented a lucid, technical paper on 'Lessons Learned in the PLATO Elementary Reading Curriculum Project.' Yeager's conclusion was: 'The use of computer-assisted instruction in the reading classroom is many years away. It is hoped that adequate research and curriculum development will be done long before the day comes when CAI becomes technologically feasible at the elementary level.'

Five years later--an eon of time for the microprocessor industry--the following "Press Release" should cause notice to everyone that gradual introduction of computers is most likely to be a thing of the past; engulfment is the norm.

Dateline: March 1982 New York

At the American Educational Research Association Conference, Dr. James M. Morgan of the Cincinnati Public Schools was optimistic about using microcomputers in classrooms. Morgan (1982, p. 1) stated: 'Unlike the original computer-assisted instruction 'revolution' in the early seventies, the advent of microcomputers in the schools promises to make a lasting and significant change in the

ways in which children learn. The ease of access and use of micro-computers together with the increasing availability of better quality software means that students and teachers of the future will be as familiar and comfortable with the computer in their classrooms as they now are with pencils and chalk.'

Fads have come and passed before; a momentary big splash, a few ripples, and then little if any residue is left. We have a right to be skeptical, for we have seen fads before, but computers are not a fad. Note what others have said:

The National Center for Education Statistics (NCES) reports that the number of microcomputers used for instructional purposes in public schools has tripled since 1980...(FTP-NEA ADVOCATE, November 1982, p. 16).

The Computer age is here. Computers are not a fad, they are not too expensive, and they won't go away...(Holly O'Donnell, 1982, p. 490).

Computers are not going away. New, computer technology has promise of revolutionizing the teaching-reading-learning process. But before the present and the future, there has been a past; therefore, a look backward is in order.

Computers are in schools and homes now, not in all schools and all homes of course, but in more than many of us realize. The explosiveness is perhaps better understood perceiving these statistics. (Greenwald, 1982).

1980	35,000
1981	215,000
1982	1,500,000*(Estimated)
1983	3,500,000*(Estimated)

Use of computers for teaching and managing reading skills is a decade-old development, building in momentum to perhaps an explosive impact. Indeed it is timely to explore the relative value of this new electronic medium from the perspective of a reading educator.

THE MAIN REASON FOR BEING HERE IS TO ANSWER THIS QUESTION:

The following question provides focus to this paper. Can computers affect reading achievement of K-12 students? For those of you who wish to leave early, the answer is yes, no, maybe.

But I can't stop with that. I have to tell you how I have come to those answers.

The beginning of computer technologies applied to reading instruction has passed. The decade of 1964-74 is behind us and, generally speaking, this era marked the initial efforts of educator-pioneers who blended computer technology into reading instruction. Though the birthing period for reading instruction administered by computers was characterized by large computers in contrast with current use of mostly typewriter-sized microprocessors, the principles remain the same. Findings of the earlier era are illustrative and many are applicable.

The beginning reading-computer decade (1964-74) was marked by several principle, computer projects. Trial and error and cost notwithstanding, these efforts were successful in demonstrating the computer could be used successfully in several ways. At Stanford University, with cooperation from IBM, Atkinson and Hansen (1966), Atkinson and Fletcher (1972), Atkinson (1974), using the schools in the area,* employed Computer-assisted Instruction (CAI). Their experiments yielded considerable insight into the value of CAI. Computer technology was initially conceptualized as a virtual replacement for the teacher and directed at the total curriculum. Atkinson and Hansen (1966) became aware that such a program would be cost-prohibitive on a large scale basis and, also, discovered that only some aspects of instruction could be done effectively using the computer. On other jobs, the computer offered no advantages and possibly some disadvantages over a classroom teacher. By the mid 1970's, these researchers redirected their orientation from the computer having the capability of being the focal point of instruction for the total curriculum to moving in the direction of developing low-cost CAI to supplement

*Brentwood Elementary School in East Palo Alto, CA, has the distinction of being the first to use a computer-based reading program (Blanchard, 1980).

classroom teaching concentrating on those tasks in which individualization is critically important.

The University of Illinois's Computer-based Education Laboratory developed "Programmed Logic For Automatic Teaching Operation." The PLATO system, originally funded by the National Science Foundation from 1971-76, has undergone considerable revision and is today known as Control Data PLATO. Starting about the same time as the Stanford project, PLATO was not programmed for reading until the 1970's (Blanchard, 1980). By 1977 "Elementary Reading on PLATO IV" (Obertino, et al., 1977) was available.

How did the "PLATO Elementary Reading Curriculum Project" go? In Yeager's mind, PERC's ambitions exceeded its abilities. That it fell short in some areas should be no embarrassment, for much was accomplished. A closer look at what went on in Champaign and Urbana in 1974-75 and 75-76 school years is interesting and follows in a moment or two.

Brigham Young University in a joint venture with the Mitre Corporation developed TICCIT: Time shared, Interactive, Computer-Controlled Information Television. It was the Mitre Corporation's responsibility to design and implement the TICCIT Computer operating system and BYU's responsibility to design the courseware (Fletcher, 1975). Currently, TICCIT seems available in higher education institutions only which is outside the purview of this paper.

School systems and individual schools have engaged in computer use in reading programs. I'll give you three examples for illustrative purposes.

Some early researchers used "Talking typewriters." O.K. Moore in Hamden, Connecticut and Richardson and McSweeney (1970) in Harlem, New York, used "Talking typewriters" to teach beginning reading skills and to pioneer equipment use. Mason (1980) reported even kindergarten children used the equipment successfully as did poor readers in the middle grades and adult illiterates.

Perhaps the largest CAI reading program is in the Chicago Public Schools. With over 850 terminals programmed with courseware from the Computer Curriculum Corporation, the Chicago Schools involve 12,000 students per day in CAI. Chicago Public Schools report that gains were at least one month for each month in the program.

In the Pueblo Indian Schools of New Mexico, students deficient in English language skills are given a computer-assisted comprehension reading program which is culturally relevant and utilizes a multiple choice CLOZE procedure deleting every seventh word. Coupled to the program are motivational techniques and alternative activities which provide reinforcement for reading skills. Student-written materials are actively solicited and used in short introductions or as lesson material. Wells and Scott report: "Students are delighted to see their work or a friend's work appear on the screen!"

Research investigations have focused on Computer-assisted reading instruction, but the paucity in number is striking. While many teachers are using computers, few are collecting hard data relative to the computer's worth. Gaining a perspective as to the computer's value to reading teachers is the purpose of this report.

Atkinson and Fletcher (1972) reported interesting results of the three-year CAI reading study. These researchers focused students' CAI modes primarily on decoding skills as they assumed other aspects of reading instruction could be taught best by teachers. Fifty pairs of kindergarten students were matched on a number of variables and divided into experimental (E) and control (C) groups. The E group received CAI during the first grade only. The C group received no CAI. Fifteen minutes a day was used in this experiment with the E group using CAI and the C group studying reading in the classroom.

Except for this fifteen minute period, the school day was the same for all children. The findings revealed the E group had a 5.05-month gain over the control. Tested a year later with no CAI treatment given in the intervening time, the difference in favor of the E group was 4.90 months. The difference between the E and C groups remained, and it is noteworthy that the CAI seemed to have made a continuing, possibly permanent difference. It was observed that boys tended to profit more from CAI instruction than girls. Atkinson noted that, from his other research studies, the data replicates the results of earlier studies. He believes that from his and other research studies CAI is effective through third grade, that students given CAI demonstrated higher reading achievement than those who did not receive computerized reading instruction.

The two principal findings so far established are that computers can be used successfully in teaching students beginning reading skills and that under controlled conditions students using computers achieved significantly higher than the controls. These findings provided an impetus to CAI use.

In 1972, Vinsonhaler and Bass reported "A Summary of Ten Major Studies on CAI Drill and Practice." These ten studies were across disciplines of mathematics (7) and language arts (3). In the view of Vinsonhaler and Bass, the effectiveness of CAI over traditional instruction seems reasonably well-established in drill practice modes for both mathematics and language arts when performance is measured by SAT- and MAT- type tests. They concluded that in the field of elementary education there appears to be little reason to doubt that CAI plus traditional classroom instruction is

usually more effective than traditional instruction alone in developing skills, at least during the first year or two.

For a doctoral study, Caldwell (1973) investigated the effect upon 14-18 year old, semi-literate adolescents of CAI reading instruction and programmed reading instruction. These Centre County, Pennsylvania students, who were reading below fifth grade level, were divided into two groups. Both groups were given an occupational information reading program as content with one group receiving CAI and the other programmed reading. Both groups achieved at a significantly higher level as determined by pre and post tests. A comparison of one group to the other revealed no significantly greater effect of one mode of instruction than to the other. The conclusion was that self-instructional programs in programmed texts and under computer control can be used effectively to individualize the teaching of reading.

At Stanford University, Atkinson, Fletcher and Suppes (Fletcher and Suppes, 1973)(Fletcher, 1975) instructed deaf students in mathematics and language arts using CAI. Their aims were to demonstrate that CAI could be used to advantage by deaf students, that CAI could support serious research in deaf education, and that a favorable argument could be made for the economics of CAI. These researchers concluded that CAI can be used successfully by deaf students, though the cost was high. They emphasized that mathematics and language arts were most amenable to computer presentation.

The cost of CAI was a major concern and is still an important consideration. Since 1973, major advances in computer design, peripherals and courseware have lowered cost substantially, below almost any educated guess of a decade ago. It is reasonable to conclude from the vantage of ten years' hindsight that Atkinson, Suppes and Fletcher were entirely successful.

Working in Ft. Worth, Texas; Lysiak, Wallace and Evans (1976) reported they found significant vocabulary and reading gains for grades 3, 6 and 7 but not in grades 4 and 5 when those students were given CAI instruction. These mixed results were unexplainable.

Litman's (1977) doctoral study at the University of Northern Illinois involved teaching intermediate grade students reading with a CAI drill and practice mode. An important aspect is the three-year duration of the study. Experimental and control groups were used for a one-year investigation. At the conclusion of the year, students were tested with the Iowa Test of Basic Skills. Analysis of the initial testing data revealed that the Experimental Fourth and Fifth graders scored higher on the reading achievement test at the end of the year of instruction than did non-CAI participants; however, for sixth graders, CAI drill and practice reading instruction appeared to be no more effective than non-CAI instruction.

Why would one assume a cause and effect relationship between CAI and achievement when no direct reading and language arts CAI was given? The inference was made that most children from poverty backgrounds see themselves as externally controlled and do not understand that there is a relationship between their own efforts and achievement. CAI appears to teach these children internal control. Even though this conclusion is circumstantial and possibly implausible to some empiricists, it is remarkable that after a sixteen-year achievement slide the computer users achieved dramatically. It is possible that the CAI treatment helped students to establish self-control as they witnessed their successes resulting from their own actions. This possible cause-and-effect factor is an element in the following study, and is the focus of Mravetz's 1980 study which follows later.

In the first year of the PLATO Elementary Reading Curriculum (PERC) experiment at the University of Illinois, Yeager (1977) reported that fifteen classrooms were equipped with two computer terminals each for the first CAI experimentation year and ten more classrooms were added in the second year, making a total of twenty-five. These classes were mostly first grades; but there were some kindergartens, second grades, and remedial reading classrooms. Even language-delayed and emotionally disturbed students were included and taught the beginning reading curriculum (Yeager, 1977). One lofty goal of PERC was to develop instruction which could be used independently at the terminal without the need for an instructor, but PERC found this goal illusive. Yeager (1977) stated that the experience in the classroom proved again that any new innovation has to be integrated into the existing classroom structure. From that conclusion, PERC has been redirected to move into a complementary classroom role.

Yeager's conclusion is important, for he is reinforcing the notion that the computer can not replace the teacher. The lessons were all beginning reading ones. The attempt to have the computer provide independent beginning reading skill instruction resulted in inadequate coverage and the determination that many lessons were unsuitable for presentation by the computer. As Yeager (1977, p. 13) say, "...they would be done better by a teacher or by some other medium."

Although the PLATO Elementary Reading Curriculum Project has been expensive, painful, and time-consuming, much was learned and accomplished. For thorough understanding, readers are urged to read the whole report. For this writer, the pertinent findings are that a variety of students learned

beginning reading skills using PLATO but the attempt to develop reading computer-assisted programs for student use on computer equipment independent of teachers was unsuccessful.

Swinton, Amarel and Morgan (1978) also relating to this project cautioned that PLATO demonstrated negative impact on first grade reading achievement in the first semester of the demonstration year.

Mravetz (1980) investigated the effects of CAI on student self concept, locus of control level of aspiration, and reading achievement. The subjects were thirty, rural, Caucasian, junior high school students who were reading a year or more below grade level. Divided into an experimental group of twenty and a control group of ten, each group was taught by the same teacher. Analysis of the data seemed to indicate that there was no significant difference in the self concept and reading self concepts. Both groups seemed to improve with the experimental groups' scores gain being proportionally higher. Differences in feelings of locus of control in reading were statistically significant, due to a negative shift in the control group. Measurement of aspiration levels indicated a shift toward more realistic learning choices. Reading achievement differences were statistically significant which suggested that the impact of CAI may encourage attitudes of individual responsibility and realistic decisions for learning.

Using CAI to teach phonics to twenty-four U.S. Navy recruits, Wisher (1980) utilized experimental and control groups. The experimental group was presented a multimedia system of instruction consisting of a minicomputer, viewing consoles, response entry keyboards and a voice synthesizer. Results did not favor either group, but both groups improved their phonics skills. Integrated back to classrooms, experimental subjects continued to perform as well as control subjects. Wisher (1980, p. 14) concluded, "...the phonics segment of

the (Academic Remedial Training) ART program is a success and is a candidate for automation "

Fifth Graders in Seminole County Florida were involved in a CAI reading comprehension study. The Experimental Group was taught interpretive comprehension skills. The treatment consisted of approximately five hours of CAI time. Midgett and Thompson (1984) reported the results were not significantly different between control and experimental subjects.

Summary of computer-assisted instructed investigation

In two decades, computer-assisted reading instruction has developed substantially. From educators using large mainframe computers located at a distance from keyboard terminals in classrooms, today reading educators are capable of using CAI on typewriter-sized equipment portable to any location and usable anywhere there is electricity. From needing computer experts to run CAI, reading teachers now can do it themselves. From not knowing whether students and teachers would like using computers, we now have assurance that both tend to appreciate them. From not knowing whether CAI would be successful in assisting students to achieve reading skill development, we now have some evidence to support the idea that CAI in reading skill areas would be more effective than teacher-directed-instruction; we now know the evidence is mixed. In some investigations CAI seemed to be more effective than teacher-directed-instruction, but many more investigations are needed before that question could be answered definitively.

IMPLICATIONS FOR TEACHING

1. Computers can be useful to reading teachers in providing computer-assisted instruction.
2. CAI currently has capability of performing teacher instructional tasks of a drill and practice type based on the Skinnerian learning

principle. However, it is not conceivable at this time that CAI could ever replace the reading teacher.

3. In the relatively few controlled studies relating to computer-assisted reading instruction, it appears that CAI can affect reading achievement equal to but no greater than teacher directed instruction.
4. In general teachers can expect their students will demonstrate positive attitudes toward computers although poorly constructed CAI lessons bore students just as poorly constructed teacher prepared and delivered lessons do.
5. Relatively few teachers were involved in the early experimental research studies as reading experimentation initially was the domain of professional computer experts who rigged these machines to provide CAI and CMI. Computers can no longer remain the rather exclusive domain of so few professors and teachers. The development of new research in substantial quantity will require the enlistment of many classroom teachers.

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